

## Assessment of Village and Community Forest Sustainability: Evidence from the Local Level

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### ABSTRACT

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The implementation of social forestry, particularly at the local level, must ensure ecological, economic, and social sustainability. The sustainability level assessment from various Social Forestry of *Perhutanan Sosial* (PS) schemes is crucial to recognize, evaluate, and improve its implementation at the local level. Therefore, this study aims to assess the sustainability level and identify the lever indicators of the sustainability of Village Forest or *Hutan Desa* (HD) and Community Forest or *Hutan Kemasyarakatan* (HKm) management as the two largest schemes of PS. The Rapid Appraisal for Village and Community Forest (RapVCF) with Multidimensional Scaling (MDS) approach was developed to assess the sustainability of the three HD and HKm cases. The results revealed that HKm SB had the highest sustainability value compared to the three HD and two other HKm. HKm SB is considered relatively sustainable, with a sustainability value above 50 in ecological, economic, and social dimensions. In general, economic and social dimensions have a lower sustainability value compared to the ecological dimension. Some indicators play a pivotal role to the sustainability level of HD and HKm, namely conditions and changes in forest cover, the manageable area, market coverage, income for forest management, claims/mastery of working areas, and benefit distribution mechanisms. Evaluation and improvement of these indicators must be prioritized to increase the sustainability level of HD and HKm.

## 1. INTRODUCTION

Sustainable forest management has been a principle that underlies forests management since the 18th century [1]. It has developed from being the principle of mere timber production sustainability to a broader and more inclusive sustainability principle [1, 2]. Sustainable forest management serves as an approach that balances economic, ecological, and social goals, in line with the forest principles formulated at the Conference on Environment and Development held in Rio De Janeiro, Brazil, in 1992 [3]. Since then, sustainable forest management has become a universally agreed goal and an integral part of sustainable development.

Several countries have developed and adopted the concept of sustainable forest management, one of which is through Community-Based Forest Management (CBFM) [4], which is believed to be an instrument for realizing sustainable forest management from environmental, social, and economic aspects [4-6]. It can be achieved by building and developing local institutions to organize local community collective action and prevent destructive illegal activities [7].

In Indonesia, CBFM involving five Social Forestry or *Perhutanan Sosial* (PS) schemes has experienced a significant leap, especially in the last seven years. Until April 2022, the PS area had reached 4.93 million hectares, a tenfold increase compared to 2014. However, the increase of PS area does not automatically guarantee sustainable forest management, especially when it was merely about transferring rights and

responsibilities without empowering and making substantial efforts to strengthen the community's capacity [6, 8-10]. Moreover, communities around the forest were generally still struggling with needs and survival in a relatively shorter time dimension [11]. For this reason, it is essential to assess the sustainability of various PS schemes, particularly the ecological, economic, and social dimensions, to identify, evaluate, and improve the PS implementation at the local level.

A sustainability assessment of CBFM was conducted by employing different approaches. Pokharel et al. [4] applied sustainability indexes with criteria and indicators based on the consensus and assessments results of the local community. Meanwhile, Jafari et al. [12] employed a pairwise comparison technique on the sustainability criteria and indicators of CBFM in Iran. They asked several stakeholders to 'score' the performance of Dopolan Community Forest, against each of the criteria and indicator elements of sustainability. Similarly, Laksemi et al. [13] performed a closely similar multicriteria analysis technique, by comparing the importance value among sustainability indicators based on stakeholders' judgement. Sustainability measurements relying on people's perceptions or preferences will result in biased and subjective sustainability and performance values. The sustainability assessment should be based on primary data source, either as a process or output of PS management activity, that will be performed in this research.

One of the sustainability assessment techniques applied in several cases of forest management in Indonesia includes a

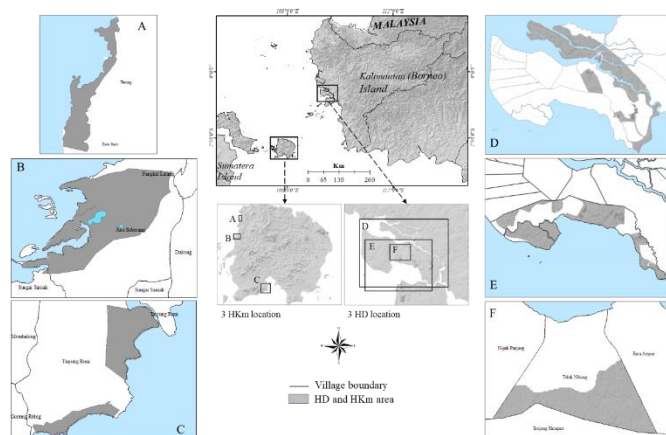
rapid appraisal technique with Multidimensional Scaling (MDS) approach. However, previous application of this approach in forestry sector is within certain regional or administrative boundaries [14-19]. In the case of CBFM, this approach was used by Sukwika et al. [20] and Nandini et al. [21]. Nevertheless, in addition to not meeting the MDS rules since it solely applied to only one unit analysis [22], the developed sustainability indicators could not be used for different schemes and characteristics of CBFM. Therefore, comprehensive and generic sustainability indicators that can be applied simply and quickly to various PHBM or PS schemes are urgently needed, especially with the increasing number of units and area of PS.

This study aims to assess the sustainability level and identify the indicators that leverage the sustainability of the three Village Forests or *Hutan Desa* (HD) and three Community Forests or *Hutan Kemasyarakatan* (HKm) as the two largest schemes of PS in Indonesia. The three HD: HD Batu Ampar (BA), HD Teluk Nibung (TN), and HD Tanjung Harapan (TH). While the three HKm are: HKm Seberang Bersatu (SB), HKm Pemuda Nelayan Pecinta Alam (PNPA), dan HKm Belantu Jaya (BJ). The rapid appraisal technique with MDS approach will be used to asses of those three HD and HKm based on ecological, economic, and social dimensions with generic indicators that can be applied to other PS schemes or cases. The study results can be utilized as input and evaluation material for the implementation of PS policies to achieve the goals of sustainable forest management.

## 2. RESEARCH METHOD

### 2.1 Time and location

This research was conducted from September 2020 to August 2021. Three HD and HKm (Table 1) were selected as the case study in this research, based on the following considerations: 1) the three HD and HKm has performed management activities with different levels of performance level; 2) the management permits (approvals) were obtained at relatively in the same time, 3) the sustainability assessments had never been conducted in the three HD and HKm.



**Figure 1.** Location of the three HKm (A: PNPA, B: SB, C: BJ) and three HD (D: BA, E: TH, F: TN)

The three HD are located in the west coast of Kalimantan (Borneo) Island, in Kubu Raya Regency, West Kalimantan Province (Figure 1). This area has a tropical wet climate in

which the average monthly rainfall is 319 mm and the average temperature is 26.8°C. More than 98% of the area has a flat topography with the average altitude is 2 m above sea level. There are three soil types in the area namely: *Histosol* (cover more than 56% of the area), *Aluvial* or *Fluvisol* (42%), and *Acrisol* or *Ultisol* (less than 2%). The area of the three HD is dominated by mangrove and peat swamp forests. Local community in HD BA uses mangrove trees to produce charcoal, as the main economic activity in the village.

The three HKm are located in Belitung Regency, Bangka Belitung Province (Figure 1). This area also has a tropical climate with monthly rainfall between 1,4 mm to 531,1 mm, with average temperature is 26.5°C. The altitude of the three HKm area is between 0 m to 2 m above sea level. *Litosol*, *Podsol* and *Aluvial* or *Fluvisol* are the main soil types in the area with high mineral content such as tin, quartz, granite and kaolin. The area of the three HKm is dominated by mangrove and heath forests. Due to historical mining activities, 75% of HKm SB area has been turns into degraded land.

**Table 1.** Selected HD and HKm

HD/HKm	Year of permit	Area (Ha)	Award
HD BA	2017	33,140	National social forestry leader (2018)
HD TN	2017	17,445	-
HD TH	2017	2,900	National third-best HD (2018)
HKm SB	2015	757	National third-best HKm (2017) and critical land restoration leader (2019)
HKm PNPA	2017	205	-
HKm BJ	2017	995	-

BA: Batu Ampar, TN: Teluk Nibung, TH: Tanjung Harapan, SB: Seberang Bersatu, PNPA: Pemuda Nelayan Pecinta Alam, BJ: Belantu Jaya.

### 2.2 Data collection

The sustainability assessment in this study was performed based on the primary field data, spatial analysis, planning documents, and financial reports/notes of the three HD and HKm. Structured interviews with questionnaires were applied to obtain data and information on the level of understanding, income, and member involvement in HD/HKm activities, which were not directly available in the field. The structured interviews involved 35 respondents for each HD and HKm, except for HKm PNPA which only involved 27 respondents, based on the number of its members. Meanwhile, in-depth interviews and field observations were carried out to confirm the data and information that had been obtained. The in-depth interview informants included the heads and facilitators/forestry extensions of all HD and HKm, village government, local forestry service, and other stakeholders with information relevant to the study objectives.

### 2.3 Data analysis

The sustainability assessment was conducted using a rapid appraisal technique, which was initially developed and applied in the fisheries sector known as Rapfish (Rapid appraisal for Fisheries). Though it was originally designed for the fisheries sector [23-25], Rapfish can be applied to different sectors [22] including forestry [15, 17-21]. Similar to Rapfish, the Rapid appraisal for Village and Community Forest (RapVCF)

employs the multi-criteria principle with the MDS algorithm. MDS maps the value gap between one unit and another by scaling, meaning that it cannot be carried out if there is only one analysis unit [22]. In addition, the recommended number of indicators or attributes in each dimension is between 6 to 12 [22, 26].

The sustainability assessment consists of four stages, which are [22, 24]: 1) identification and determination of indicators and assessment criteria; 2) assessment of each indicator; 3) sustainability assessment through ordination techniques using MDS, sensitivity analysis (leverage analysis), and anomaly analysis (Monte Carlo analysis); and 4) interpretation of the sustainability assessment results.

A total of 23 indicators (Table 2), were used to assess the sustainability of the three HD and HKm managements. These indicators were formulated from the criteria and indicators for evaluating the implementation of PS management under the Regulation of the Minister of Environment and Forestry (MoEF) number 9/2021, previous relevant studies [12, 14, 17, 19-21, 27-29], and focus group discussion in the three HD and HKm. In addition, the indicator determination also considered the data and information that could be collected easily and objectively, and allow the extreme values of "good" and "bad" [22].

Each indicator was assessed based on data and information obtained from previous steps. Even though since 2013 Rapfish has used a scale of 0-10 [22, 26], in this study, however, we used a scale of 0-4 [24], since the qualitative and descriptive indicators had a limited range of assessment criteria. Apart

from that, there are no restrictions/prohibitions of using 0-4 scoring scale, and has been widely used by various researchers. The value of 0 indicating bad score, and 4 indicating good score.

The sustainability ordinance results are visualized in a two-dimensional curve. Only horizontal axis indicating sustainability level on a scale of 0 (bad) to 100 (good). The vertical axis is a variation that does not correlate with the sustainability level [22, 26]. Previous researchers [17, 20, 21] divided the sustainability degree into four categories, i.e., unsustainable (value 0.0-25.0), less sustainable (26.01-50.0), moderately sustainable (50.01-75.0), and sustainable (75.01-100).

The leverage analysis was conducted after the ordination to discover sensitive indicators or leverage sustainability values [22]. The leverage values ranged from 2%-6% as measured by the change in Root Mean Square (RMS). The Monte Carlo analysis was performed to evaluate and detect the random errors on rapid appraisal model [22]. Errors may result from various conditions, such as error in determining and scoring indicators, missing data or entry error. The Goodness of Fit analysis in the MDS indicating the precision of the configuration of a point following its original condition was executed by calculating the stress (S) values and the coefficient of determination ( $R^2$ ). In general, an S value less than 0.25 is considered acceptable [25]. Meanwhile, an  $R^2$  close to 1 indicates good results [20]. The entire assessment process was carried out using Rapfish tools, an add-in tools in Microsoft Excel.

**Table 2.** Sustainability indicators of HD and HKm management

Indicators	Operational definition	Scale determination	Data Sources
Ecological Dimension			
Clarity of area boundaries	HD/HKm area boundaries are defined as well as those with clear natural boundaries.	0: having no clear boundaries in the field; 1: having clear boundaries of less than 25%; 2: having clear boundaries of 26-50%; 3: having clear boundaries of 51%-75%; 4: having clear boundaries of 75-100%	Map of forest area boundaries (MoEF); HD/HKm area maps; field observations
Management zoning/block	The HD/HKm area is divided into at least two management zoning (protection/conservation and utilization) to limit and protect certain areas to be maintained/protected.	0: having no management zoning/block; 1: having maps and zoning plans but unimplemented; 2: having a utilization zone as the reference in management; 3: having a protection/conservation zone as a reference for effective management to protect forest resources; 4: having a management zoning as a reference for community management and activities.	Management plan documents; zoning maps; informant interviews; field observations
Forest cover in the protected zone	Percentage of forest cover in protected/conservation zones	0: having no forest cover; 1: having forest cover of 25%; 2: having forest cover of 26-50%; 3: having forest cover of 51-75%; 4: having forest cover of 76-100%;	Spatial analysis of satellite imagery (SPOT 7) and land cover maps
Changes in forest cover	Changes in forest area coverage	0: forest cover decreases; 1: forest cover area remains constant; 2: the area of forest cover increases naturally; 3: the area of forest cover increases through HD/HKm management (rehabilitation) activities	Analysis of satellite imagery (SPOT 7) and land cover maps; informant interview; activity records/reports field observation;
Rehabilitation/planting	Planning and rehabilitation/planting activities and the ability to carry out rehabilitation independently	0: Having no plans and rehabilitation/planting activities; 1: having plans but unimplemented; 2: conducting activities only with external support; 3: performing rehabilitation/planting activities independently	Management plan documents; activity records/reports; informant interviews; field observations
Forest protection	Planning and forest protection activities (control of illegal activities, forest and land fires, etc.) and the ability to perform these activities independently	0: having no forest protection plans and activities; 1: having a plan but unimplemented; 2: carrying out activities only with external support; 3: performing activities regularly	Management plan documents; activity records/reports; informant interviews; field observation

Indicators	Operational definition	Scale determination	Data Sources
Biodiversity management	Biodiversity management planning and activities (inventory, documentation, and management of flora and fauna diversity) and the ability to carry out activities independently	0: having no plans and activities for biodiversity management; 1: having an activity plan but unimplemented; 2: conducting activities only with external support; 3: performing activities regularly	Management plan documents; activity reports; informant interviews; field observations
Areas that have been managed or are within the scope of management	The area that has been managed and/or is under the control of HD/HKm management	0: the whole area is unmanaged; 1: the managed area is up to 25%; 2: the managed area is between 26% and 50%; 3: the managed area is between 51% and 75%; 4: the managed area is between 76% and 100%.	Spatial analysis of satellite imagery and land cover maps; management plan; activity records/reports; informant interviews; field observations
<b>Economic Dimension</b>			
Contribution to the local economy	Economic contribution (directly or indirectly, including the obligation to pay taxes, non-tax state revenues, etc.), especially in rural/local areas	0: having no contributions; 1: having an indirect contribution from the activities carried out (rehabilitation, construction of infrastructure, and so forth); 2: having an indirect contribution from sales of forest products and/or ecotourism activities; 3: having a direct contribution from profit sharing; 4: having a direct contribution from profit sharing and income tax	Income/financial records/reports, tax payments report; informant interviews
Income from HD/HKm	The average proportion of the household income of the HD and HKm members (average)	0: having no contribution to member income; 1: having a proportion of income from HD/HKm up to 25%; 2: having a proportion of income from HD/HKm of 26-50%; 3: having a proportion of income from HD/HKm of 51-75%; 4: having a proportion of income from HD/HKm of 76-100%.	Financial notes/reports; structured interviews (questionnaires) and informant interviews
Number of members earning income	Number of members earning income from HD and HKm activities	0: none; 1: up to 25% of members; 2: 26-50% of members; 3: 51-75% of members; 4: 76-100% of members	Financial notes/reports; structured interviews (questionnaire); informant interviews
Market reach	Market reach from sales of forest products and/or tourist visitors	0: no products have been marketed yet; 1: market reach the local level (village/sub-district/district); 2: market reach the local and provincial level; 3: market reach the local, provincial, and national levels; 4: market reach the local, provincial, national, and international (export) levels	Forest product sales reports/notes; tourists visit reports; informant interviews
Variety of forest product	The variety of produced forest products, both timber and non-timber, tourism, and environmental services (carbon trading, etc.)	0: having no business/utilization plan and activity; 1: having a business plan but unimplemented; 2: having one type of business/product; 3: having two types of businesses/products; 4: having more than two types of business/forest product	Management/business plan documents; activity reports; informant interviews; field observations
Source of business capital	Sources of funding for business activities (loans, assistance, personal funds)	0: no business capital/business; 1: entirely from assistance/loans; 2: mostly from assistance/loans; 3: mostly from groups and the results of forest management activities/businesses; 4: entirely from internal groups and the results of activities/businesses	Performance and financial notes/reports; external support document; informant interview
Income for forest management	Percentage of forest management costs from HD and HKm self-income	0: no income is used to support forest management; 1: up to 25% of management activities come from self-income; 2: 26-50% of management activities come from self-income; 3: 51-75% of management activities come from self-income; 4: 76-100% of management activities come from self-income	Financial notes/reports; informant interview
Business group	Number of business groups in the form of Social Forestry Business Groups or <i>Kelompok Usaha Perhutanan Sosial</i> (KUPS) as well as other form within the HD/HKm organizational structure, and their level of performance	0: no business group; 1: business group exists but not in operation; 2: one business group has operated; 3: two business groups have operated; 4: more than two business groups have operated	Planning documents; activity reports; informant interviews; field observations
<b>Social Dimension</b>			
Member involvement	Percentage of members actively involved in HD/HKm activities	0: no members involved; 1: a maximum of 25% of the members involved; 2: 26-50% of the members involved; 3: 51-75% of the members involved; 4: 76-100% of the members involved	Structured interviews (questionnaire); informant interviews;

Indicators	Operational definition	Scale determination	Data Sources
Benefit distribution mechanism	Mechanism of distribution of income/profits or other benefits of HD/HKm	0: no distribution of benefits; 1: determined by certain parties (head of HD/HKm, village head, external actors' certain members, and others); 2: determined by the group without standard/binding stipulations/rules; 3: there is a standard/binding benefit distribution mechanism that is mutually agreed upon, and implemented in the field	Planning documents; group/cooperatives distribution mechanism regulation/rules; financial reports/notes; informant interviews
Claim/control of the area	Claim of the area by the local community or other parties outside the HD/HKm management scheme	0: more than 76% of the area controlled/claimed; 1: 51-75% of the area controlled/claimed; 2: 26-50% of the area controlled/claimed; 3: up to 25% of the area controlled/claimed; 4: the entire areas is fully controlled/managed by HD/HKm	Satellite imagery and land cover maps analysis; informant interviews; field observations
Management conflict	Impacts and conflict resolution mechanisms in the management of HD/HKm both within the group (between management and members) and external parties (village government, illegal squatters/miners, private companies, other community groups, and so forth)	0: HD/HKm management is unable to work due to conflicts; 1: conflicts cause disturbances in forest management even though they are still ongoing; 2: Conflicts do not interfere with HD/HKm management, but there is no mechanism for resolving them; 3: conflicts do not interfere with the management of HD/HKm and can be resolved by existing mechanisms; 4: no conflict in HD/HKm management	Conflict records/reports; informant interviews
Dissemination/assistance/extension	Frequency of dissemination/assistance/extension activities as well as capacity building (planning, implementation of activities, business management, and institutions)	0: no dissemination/assistance activities; 1: 1-2 times per year; 2: 3-4 times per year; 2: 5-6 times per year; 4: >6 times per year	Reports/records on assisting/disseminating activities; informant interviews
Community understanding	Level of member understanding of the roles and rules of HD and HKm management	0: all have no such understanding; 1: up to 25% of respondents understand; 2: 25-50% of respondents understand; 3: 51-75% of respondents understand; 4: 76-100% of respondents understand	Structured interviews (questionnaire); informant interviews
Group meeting	Frequency of meetings/deliberations conducted by management and members of HD/HKm, including business group meetings	0: no regular group meetings/deliberations; 1: regular meetings/deliberations are held once a year; 2: meetings/deliberations are held twice a year or every six months; 3: regular meetings/deliberations are held once a month; 4: meetings are regularly held weekly, monthly, and annually	Plan documents and activity reports; informant interviews

### 3. RESULTS AND DISCUSSION

#### 3.1 Ordinance on the sustainability of HD and HKm management

Figures 2 and 3 present the ordinance results on the sustainability of the three HD and HKm management for the ecological, economic, and social dimensions. With an S value lower than 0.25 and an R<sup>2</sup> value higher than 0.9, the ordinance results on the three sustainability dimensions were considered good and could indicate the actual conditions.

The Monte Carlo analysis results illustrated in the scatter plot (Figure 4) demonstrate the sustainability value distribution that tends to be dense and close to the initial ordinance value. It implies that the changes in the sustainability values were insignificant, and the ordinance results could overcome random errors [22, 30]. Based on these indicators, the ordinance analysis was considered accurate to assess the degree of sustainability in the HD and HKm management.

Based on Figures 2 and 3, HKm SB has the highest level of ecological, economic, and social sustainability compared to the other three HD and two HKm. With a sustainability value ranging between 60 and 75, the management of HKm SB could be considered moderately sustainable in terms of

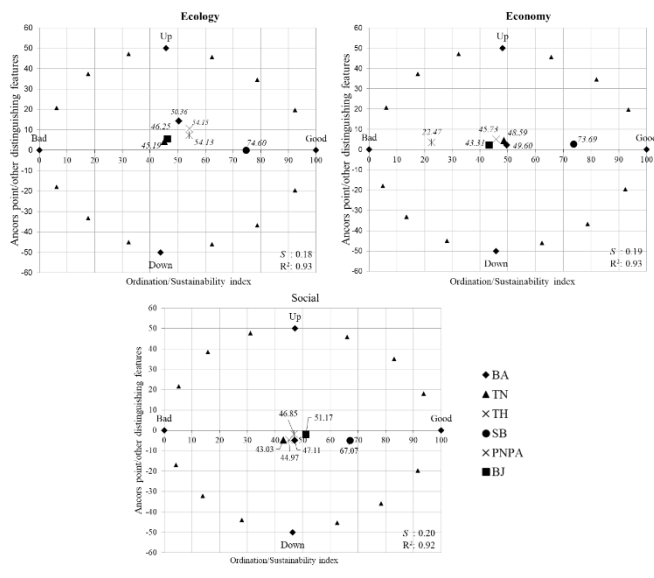
ecological, economic, and social dimensions. Most of the other three HD and two HKm had sustainability values below 50, considered less sustainable. The sustainability values of the three dimensions in each HD and HKm were relatively close (Figure 3), except for HKm PNPA, with an economic sustainability value much lower than the ecological and social sustainability values.

##### 3.1.1 Ecological sustainability

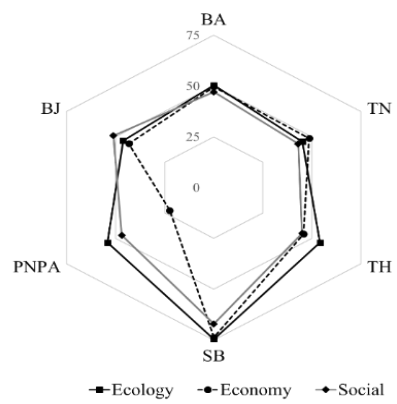
The three HD and HKm mostly reached ecological sustainability values above 50 or moderately sustainable, except for HD TN and HKm BJ, with ecological sustainability values of 45.19 and 46.25, respectively. The high ecological sustainability value (74.6) of HKm SB was generated from indicators of good management performance, such as the increasing forest cover, rehabilitation, forest protection, and manageable area. Meanwhile, the ecological sustainability values of HD BA, HD TH, and HKm PNPA were mainly generated from forest cover and clear area boundaries indicators, which did not directly represent the management performance of these HD and HKm.

Although HKm SB demonstrated the lowest forest cover among the other three HD and two HKm (Figure 5a), the rehabilitation and protection activities increased the forest cover (Figure 5b). HKm SB had special nurseries and field

executors responsible for plant nurseries as well as forest rehabilitation and protection, which were absent in the other three HD and two HKm. The success of HKm SB in rehabilitation activities had even been appreciated at the national level. As noted by Pokharel et al. [4] in the case of CBFM in Nepal, HKm SB also succeeded in preventing and restricting other parties from performing illegal activities, especially mining, in their area.



**Figure 2.** Results of the ordinance of ecological, economic, and social sustainability

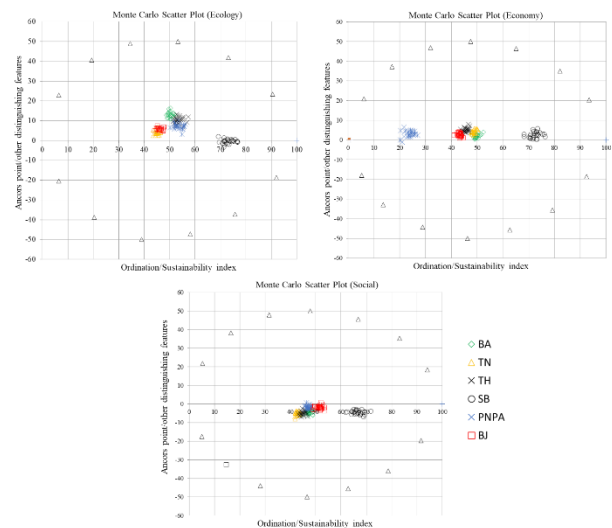


**Figure 3.** Radar diagram for the sustainability of HD and HKm

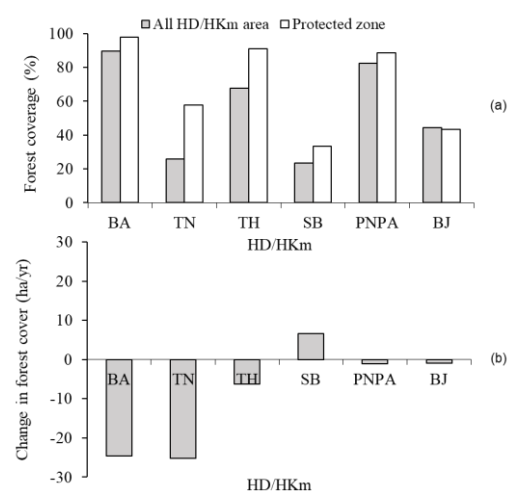
The different condition occurred in the other three HD and two HKm. Although at a declining rate, their forest cover is still decreasing (Figure 5b). In HD BA, mangrove logging as one of the charcoal raw materials caused a decline in the mangrove forest area and had an impact on decreasing fish, shrimp, and crab catches [17]. In HD TN and TH, the decline in forest cover was primarily triggered by the expansion of agricultural land and plantations, as well as the fulfillment of local timber needs. In HKm PNPA, the small decline in forest cover was grounded by mangrove forest clearing in the protected zone for crab cultivation conducted by other parties. In HKm BJ, forest clearing for oil palm plantations and agricultural land were the fundamental grounds for the decline in forest cover.

In the three HD, HKm PNPA dan BJ, rehabilitation activities relied on external support. The establishment of

management zoning to regulate and limit forest utilization activities had not been fully implemented. More than 99% of the three HD areas were unmanageable because the areas were extremely large. HD BA and HD TH only utilized a small part of their areas which is close to residential for crab cultivation and honey bee collection. Honey bee cultivation activities in the three HD were performed inside residential areas and not necessarily connected to the forest area. Since the areas were not as large as HD, HKm had a relatively higher percentage of areas that had been managed or in the range of its management capacity.



**Figure 4.** The Monte Carlo analysis results

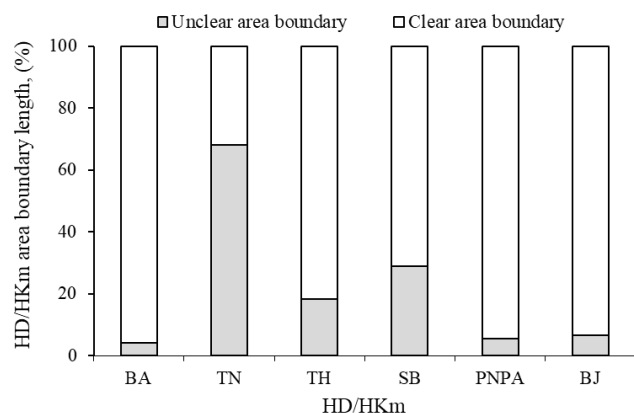


Source: Satellite images (SPOT 7) interpretation and land cover maps analysis between 2015-2020

**Figure 5.** Forest cover (a) and its changes (b) since HD and HKm obtained permit

In addition to those indicators, the low ecological sustainability value, especially in HD TN, was also caused by unclear area boundaries, as also found by Fisher et al. [9] on HD and HKm cases in South Sulawesi. The analysis results of forest area boundaries map from the Ministry of Environment and Forestry indicated that more than 70% of HD and HKm area boundaries were also national forest land boundaries that had been demarcated before 2017 (Figure 6). In HD TN, the difference between HD boundary map and the 2014 and 2016 demarcations result lead to uncertainty of more than 68% of HD TN area boundaries. In HD BA, HD TH, and the three

HKm, some areas were directly adjacent to the river and the sea resulting in clear boundaries and easier on the ground identification.



Source: Spatial analysis results of HD and HKm, and national forest area boundaries map

**Figure 6.** Conditions of HD and HKm area boundaries

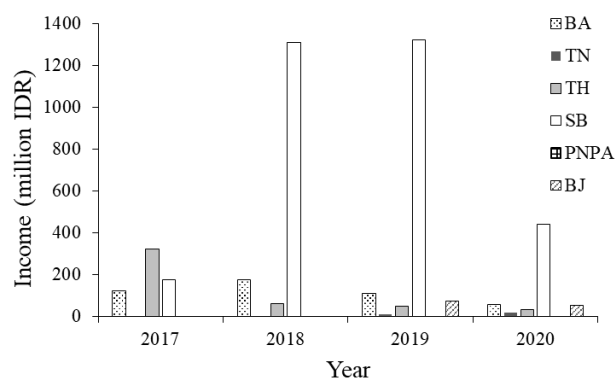
Based on the biodiversity management indicator, the three HD and HKm relatively indicated the same condition. The three HD and HKm had not prioritized biodiversity management. Biodiversity management had not been implemented in the field activities, albeit it had been included in the management plan document. In HD TH and HKm SB, inventory and documentation of flora and fauna were performed only for a project or external funding.

### 3.1.2 Economic sustainability

The ordinance results of the economic sustainability indicated that only HKm SB had a sustainability value above 50 (73.69) or relatively sustainable. The other three HD and two HKm reached economic sustainability values below 50. Moreover, HKm PNPA gained the lowest economic sustainability value of 22.47.

Among the three HD and HKm, only HKm PNPA did not have any business or utilization activity as a potential source of income for its members (Table 3). Four years after obtaining

the management permit, HKm PNPA had only become the executor of the Government's mangrove rehabilitation program. One of the objectives of establishing HKm PNPA as a tourist attraction had not been realized, which resulted in zero economic contribution. Apart from the weakness of collective action, they have limitations in providing adequate standard tourist facilities, while external support is limited.



Source: HD and HKm financial notes and/or reports

**Figure 7.** HD and HKm income values

Figure 7 shows the income earned by the three HD and HKm from forest utilization and business activities they had practiced. HKm SB earned their revenue of more than IDR1.2 billion in 2018 and 2019, far higher than the other three HD and two HKm. The decline in revenue in 2020 resulted from the cessation of tourism activities for several months due to the COVID-19 pandemic. The income was primarily coming from the entrance ticket to the tourist attractions, the fish, crab and plant seed sales. The tourist or visitors were not only local but also those from outside of the province. In addition to providing salaries for the board of management and field executors, the profits were also distributed to HKm members according to their savings and contribution as the cooperative members, and also village communities in the form of educational and social funds. Since 2018, HKm SB has begun to meet most of the operational and forest management costs, as well as pay the income tax to the government.

**Table 3.** Types of utilization/businesses activities, sources of funds, and income distribution

HD/HKm	Types of utilization/businesses	Sources of funds/business capital	Income distribution
HD BA	Utilization and cultivation of honey bees and crabs	Loans and financial assistance from the Government and donor agencies	Distributed to the members or groups practicing the utilization and business activity
HD TN	Honey bee cultivation	Honey production equipment was provided by the Government	Distributed to each member practicing the honey bee cultivation
HD TH	Honey bee and crab cultivation	Financial assistance from the Government and donor agencies	Distributed to the members practicing the utilization and business activity <ul style="list-style-type: none"> <li>• Wages for the board of management and members</li> <li>• HKm management operational costs</li> </ul>
HKm SB	<ul style="list-style-type: none"> <li>• Mangrove and beach tourism</li> <li>• Fish and crab cultivation</li> <li>• Plant nursery</li> <li>• Eatery and culinary</li> </ul>	The construction of tourist facilities was funded by external assistance, and membership fees/donation	<ul style="list-style-type: none"> <li>• Distributed to HKm cooperative members according to their savings and contribution</li> <li>• Social and educational funds</li> <li>• Income tax</li> </ul>
HKm PNPA	No utilization and business activities	-	-
HKm BJ	Mangrove and beach tourism, as well as honey bee cultivation	The construction of tourist facilities was funded by village funds	<ul style="list-style-type: none"> <li>• Operational and maintenance costs of tourist facilities</li> <li>• Distributed to the local people practicing the honey bee cultivation</li> </ul>

HKm BJ's income from the tourist attractions was utilized to maintain and develop the inadequate tourist facilities. Due to the limited number of available tourist attractions and the relatively distant location from the city center, the visitors were dominated by the local community. Honey bee cultivation activities were only carried out individually and benefited several HKm members who have expertise in harvesting wild honey. As in HKm PNPA, around 35% of HKm BJ members received wages as rehabilitation program executors from the Government.

Utilization and business activities in the three HD were generally carried out individually. With the support of partners and agents/collectors, the honey and crabs produced could be marketed outside West Kalimantan, particularly to the Java Island. The income earned became the right of each individual or group that performed utilization and cultivation activities. In all three HD, not more than 45% of members were involved in utilization activities and earned income. In HD BA, the average income earned was 45% of the total household income, while in HD TN and HD TH, the average income earned was around 32% and 33% of household income, respectively. None of the income earned in the three HD was allocated to fund the HD management activities. Moreover, crab cultivation activity in HD TH completely stopped at the end of 2019 since none of the income reallocated to fund the cultivation activities. The chairman of HD TH that controls crab cultivation uses the income for personal unproductive interests.

### 3.1.3 Social sustainability

HKm SB also indicated higher social sustainability compare to the three HD and the other two HKm. Besides HKm SB, HKm BJ demonstrated a social sustainability value of more than 50 and was considered moderately sustainable. The other three HD and HKm PNPA indicated a score below 50 or considered less sustainable.

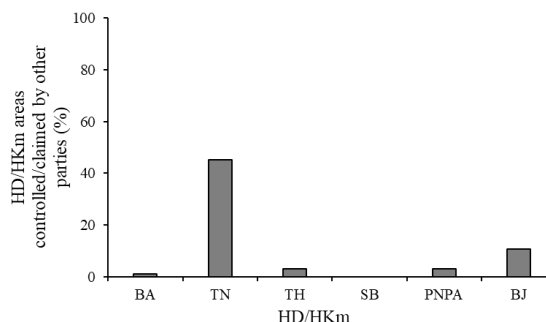
One of the expected benefits of PS is creating job and business opportunities for local communities, as a solution to unemployment and poverty [27, 31, 32]. In the three HD and HKm, the utilization, and business activities were solely performed by the board of management and only few members involved. Apart from HKm SB, which employed a cooperative membership mechanism to distribute profits, most of the income and profits were distributed to individuals or groups that carry out the utilization and business activities by themselves.

Of the three HD and HKm, only HKm SB managed and controlled almost all of its area. In HD TN more than 45% of their area covered by coconut plantations and agricultural land which is managed and controlled by the community personally (Figure 8). In HKm BJ, 10% of its area was planted with oil palms that managed and controlled by the community individually.

The communities that have managed the HD and HKm areas for ages were generally disinclined to "hand over" the land they managed. Apart from weakening the legitimacy of HD and HKm, without a clear mechanism, individual control of HD and HKm areas can set a precedent for other communities to take the same action.

Conflicts in the management of HD and HKm also contributed to the low level of social sustainability (Table 4). Although it did not cease the whole management activities, the conflict caused HD and HKm could not optimally perform their management practices. For instance, in HD BA and TH, interest conflicts in the village head election caused the two

HD to lose the support from the elected village heads. The village government has changed the HD TH management board, resulting in the emergence of dualism management. In HKm SB, mining activities were exposed during the field research, albeit it was greatly reduced and controlled.



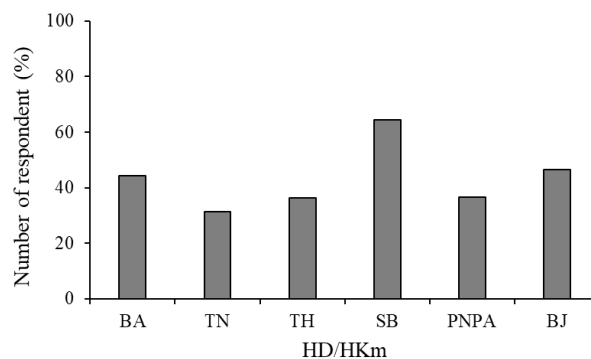
Source: Satellite imagery (SPOT 7) interpretation and informant's interview

**Figure 8.** Proportion of HD and HKm areas under the control of other parties

**Table 4.** Sources/forms of conflict in the HD and HKm management

HD/HKm	Sources/forms of conflict
HD BA	<ul style="list-style-type: none"> <li>Utilization of mangrove forests for charcoal's raw materials in protected zones</li> <li>Differences in loan fund management</li> <li>Unfair distribution of the support</li> <li>Conflict of interest in local political controversy</li> </ul>
HD TN	<ul style="list-style-type: none"> <li>Unfair support distribution</li> <li>Timber use and forest clearing in protected zones</li> <li>Nontransparent support distribution</li> </ul>
HD TH	<ul style="list-style-type: none"> <li>Conflict of interest in local political controversy</li> <li>Timber use and forest clearing in protected zones</li> </ul>
HKm SB	<ul style="list-style-type: none"> <li>Mining activity in HKm area</li> </ul>
HKm PNPA	<ul style="list-style-type: none"> <li>Nontransparent fund management and the head's dominance in the management of HKm</li> </ul>
HKm BJ	<ul style="list-style-type: none"> <li>Forest clearing for plantations and agriculture</li> </ul>

Due to the low level of community involvement, the roles and rules in the management of HD and HKm were not adequately understood. In HKm SB, 64% of respondents claimed that they understood the roles and rules in the management of HKm. On the other hand, in three HD and two other HKm, more than 50% of the respondents stated that they do not understand the roles and rules of HD and HKm management (Figure 9).



**Figure 9.** Respondents who understand HD/HKm roles and rules

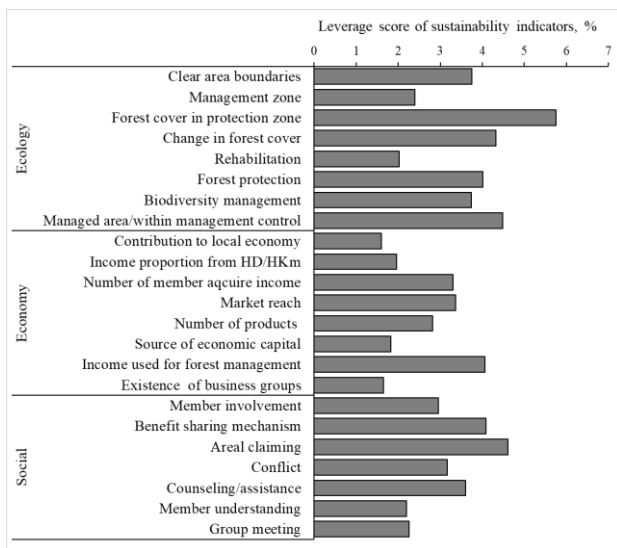


The organizational activities in the three HD did no longer operate due to the cessation of facilitation and assistance provided by the Non-Governmental Organization (NGO) of Sampan Kalimantan in early 2020. As a result, the three HD relied on the roles of the PS community facilitators from the Government. With a limited budget, mentoring activities were only carried out a maximum of twice a year and completely ceased at the end of 2020. Apart from being assessed as having developed, mentoring activities were prioritized for newly formed PS units. Group meetings during the planning stage at the beginning of the year and evaluation at the end of the year would not be executed without the facilitators' initiative and encouragement. In addition, the high dependence on the roles of the facilitator drove the three HD to experience difficulties in marketing and funding access.

In addition to HKm SB, which was already considered self-sustain, the mentoring process was essential to encourage organizational activities (group meetings, planning, reporting, and preparing the funding proposals) and forest management activities. The range and frequency of assistance provided in the three HKm were constrained by the low number of forestry extensions and budget limitation. Mentoring activities in HKm SB and PNPA were conducted approximately three to four times a year due to their proximity and accessibility. On the other hand, HKm BJ was rarely mentored. In 2020, the assigned forestry extensions officials did not even visit HKm BJ.

### 3.2 Sustainability leverage indicators

The results of the leverage analysis (Figure 10) show a change in the ordinance value of each criterion if the indicator is removed. Leverage analysis also described the indicator sensitivity [22, 24, 33].



**Figure 10.** Leverage of HD and HKm sustainability values

The three main factors that influenced sustainability in the ecological dimension includes forest cover in the protected zones, managed areas, and changes in forest cover. If these indicators were omitted, the ecological sustainability ordinance would increase from 4% to 6%. Forest cover was also the most significant indicator of ecological sustainability in the HKm Babak, Lombok [21] and CBFM in Nepal [4]. In the economic dimension, the indicators that most influenced sustainability are forest management income (4.06%), market

access (3.36%), and the number of members who earned income (3.30%). The forest management income was one of the indicators utilized in sustainable CBFM certification [34]. For social dimension, claims or control over HD and HKm areas (4.61%), benefit distribution mechanisms (4.08%), and assistance/counseling (3.61%) were the three most influential sustainability indicators.

### 4. CONCLUSIONS

The sustainability status of the three HD and HKm can be described comprehensively through RapVCF analysis with the MDS approach. This sustainability assessment can be used as a tool to determine the sustainability status and effectiveness of PS implementation.

The sustainability assessment results indicate that HKm SB achieves the highest sustainability value of compare to the three HD and two other HKm. HKm SB is considered moderately sustainable in terms of ecological, economic, and social dimensions with a sustainability value between 60 and 75. HKm PNPA and HKm BJ are considered relatively sustainable on the ecological and social dimensions, respectively, but less sustainable on the economic dimension. Of the three HD cases, HD BA and HD TH are considered moderately sustainable on the ecological dimension but less sustainable on the economic and social dimensions. Meanwhile, HD TN is considered less sustainable with value below 50 in all the three sustainability dimensions. Of the three HD and HKm cases, the economic and social dimensions indicate a lower sustainability value than the ecological dimension.

Several indicators serving as the leverage on the ordinance of HD and HKm sustainability include conditions and changes in forest cover, managed area, market reach, income used for forest management, area claims/control by other parties, and benefit distribution mechanisms. These indicators should be the primary focus of the Government and other parties in designing facilitation and extension activities to improve the sustainability of the HD and HKm management systems.

The results of this study amplify the conclusions from previous studies which state that the implementation of PS is heavily focused on the permit process and administrative fulfillment. Without sufficient facilitation and support to the local communities in managing their forest, social forestry's noble goal and sustainability will just become a utopia. Therefore, the government attention and resources must be shifted to support and strengthen the implementation and monitoring of forest management activities at the local level through PS schemes.

This research is conducted in three HD and HKm as unit analyses. Further research with a larger analysis unit involving other PS schemes is required to refine indicators and acquire more comprehensive study results on the PS sustainability status.

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## APPENDIX

### Appendix 1. Structured Questionnaires

1. Do you involve in HD/HKm management activities?
  - a. Yes, I am involved
  - b. Not, I am not involved
2. If you were involved, do you get any income from HD/HKm management activities?
  - a. Yes, I get an income
  - b. No, I don't have any income from HD/HKm
3. If you get an income from HD/HKm activities, how much (in average) compared to your total household income? .....% of household income
4. Do you understand of your role in HD/HKm Management?
  - a. Yes, I understand my role in HD/HKm management
  - b. No, I don't understand my role in HD/HKm management
5. Do you understand the rules in HD/HKm management?
  - a. Yes, I understand my role in HD/HKm management
  - b. No, I don't understand my role in HD/HKm management